

Lesson 7-5

Factoring Linear Expressions



Interactive Study Guide

See pages 159–160 for:

- Getting Started
- Real-World Link
- Notes



Essential Question

Why are algebraic rules useful?



Common Core State Standards

Content Standards
7.EE.1

Mathematical Practices
1, 2, 3, 4, 7



Vocabulary

factor
factored form

What You'll Learn

- Find the greatest common factor of two monomials.
- Use properties to factor linear expressions.



Real-World Link

Marching Band Band directors create geometrical formations that are eye-catching and exciting but still follow the rhythm and feel of the music. Graph paper is used to draw formations, with different colored ink representing different sections of the band.



Find the GCF of Monomials

To **factor** a number means to write it as a product of its factors. A monomial can be factored using the same method you would use to factor a number. The greatest common factor (GCF) of two monomials is the greatest monomial that is a factor of both.

Example 1



Find the GCF of each pair of monomials.

a. $4x, 12x$

$$4x = 2 \cdot 2 \cdot x$$

Write the prime factorization of $4x$ and $12x$.

$$12x = 2 \cdot 2 \cdot 3 \cdot x$$

Circle the common factors.

The GCF of $4x$ and $12x$ is $2 \cdot 2 \cdot x$ or $4x$.

b. $18a, 20ab$

$$18a = 2 \cdot 3 \cdot 3 \cdot a$$

Write the prime factorization of $18a$ and $20ab$.

$$20ab = 2 \cdot 2 \cdot 5 \cdot a \cdot b$$

Circle the common factors.

The GCF of $18a$ and $20ab$ is $2 \cdot a$ or $2a$.

Got It? Do these problems to find out.

Find the GCF of each pair of monomials.

1a. $12, 28c$ **4**

1b. $25x, 15xy$ **5x**

1c. $42mn, 14mn$ **14mn**

Factor Linear Expressions

You can use the Distributive Property and the work backward strategy to express an algebraic expression as a product of its factors. An algebraic expression is in **factored form** when it is expressed as the product of its factors.

$$\begin{aligned}8x + 4 &= 4(2x) + 4(1) && \text{The GCF of } 8x \text{ and } 4 \text{ is } 4. \\&= 4(2x + 1) && \text{Distributive Property}\end{aligned}$$

Example 2



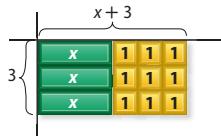
Factor each expression.

a. $3x + 9$

Method 1 Use a model.



Model $3x + 9$.



Arrange the tiles into equal rows and columns.
The rectangle has a width of three 1-tiles, or 3, and a length of one x-tile and three 1-tiles, or $x + 3$.

So, $3x + 9 = 3(x + 3)$.

Method 2 Use the GCF.

$$\begin{aligned}3x &= 3 \cdot x && \text{Write the prime factorization of } 3x \text{ and } 9. \\9 &= 3 \cdot 3 && \text{Circle the common factors.}\end{aligned}$$

The GCF of $3x$ and 9 is 3 . Write each term as a product of the GCF and its remaining factors.

$$\begin{aligned}3x + 9 &= 3(x) + 3(3) \\&= 3(x + 3) && \text{Distributive Property}\end{aligned}$$

So, $3x + 9 = 3(x + 3)$.

b. $12x + 7$

Find the GCF of $12x$ and 7 .

$$12x = 2 \cdot 2 \cdot 3 \cdot x$$

$$7 = 1 \cdot 7$$

There are no common factors, so $12x + 7$ cannot be factored.

Factoring Expressions

Use algebra tiles to model the expression in Example 2b. Since you cannot rearrange the tiles to make a rectangle, the expression cannot be factored.

Got It? Do these problems to find out.

Factor each expression. If the expression cannot be factored, write **cannot be factored**. Use algebra tiles if needed.

2a. $4x + 28$ **$4(x + 7)$**

2b. $3 + 33x$ **$3(1 + 11x)$**

2c. $4x + 35$ **cannot be factored**



Example 3

Tutor

The garden at the right has a total area of $(15x + 18)$ square feet. Find possible dimensions of the garden.

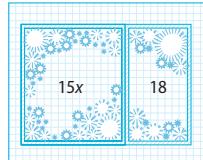
Factor $15x + 18$.

$$15x = 3 \cdot 5 \cdot x$$

Write the prime factorization of $15x$ and 18 .

$$18 = 2 \cdot 3 \cdot 3$$

Circle the common factors.



The GCF of $15x$ and 18 is 3 . Write each term as a product of the GCF and its remaining factors.

$$15x + 18 = 3(5x) + 3(6)$$

$= 3(5x + 6)$ Distributive Property

So, the dimensions of the garden are 3 feet and $(5x + 6)$ feet.

Check Find the product of 3 and $5x + 6$. $3(5x + 6) = 15x + 18$ ✓

Got It? Do these problems to find out.

- 3a. Financial Literacy** The Reyes family has saved \$480 as a down payment for a new television. If x is the monthly payment for one year, the expression $\$12x + \480 represents the total cost of the television. Factor $\$12x + \480 . **\$12(x + 40)**
- 3b.** Jesse wants to put down \$100 toward a new computer and will pay it off in six months. If y is the monthly payment, what expression represents the total price? **$6y + 100$**

Guided Practice



Find the GCF of each pair of monomials. (Example 1)

1. $32x, 18$ **2**

2. $15y, 25$ **5**

3. $45a, 20a$ **5a**

4. $16b, 12b$ **4b**

5. $42s, 28s$ **14s**

6. $56g, 84gh$ **28g**

7. $27s, 54st$ **27s**

8. $18cd, 30cd$ **6cd**

9. $22mn, 11kmn$ **11mn**

Factor each expression. If the expression cannot be factored, write *cannot be factored*. Use algebra tiles if needed. (Example 2)

10. $36x + 24$ **$12(3x + 2)$**

11. $6 + 3x$ **$3(2 + x)$**

12. $4x + 9$ **cannot be factored**

13. $13x + 21$ **cannot be factored**

14. $2x - 4$ **$2(x - 2)$**

15. $14x - 16$ **$2(7x - 8)$**

16. $12 + 18x$ **$6(2 + 3x)$**

17. $24 + 32x$ **$8(3 + 4x)$**

18. $15x + 8$ **cannot be factored**

19. Mr. Phen's monthly income can be represented by the expression $25x + 120$, where x is the number of hours worked. Factor the expression $25x + 120$. (Example 3) **$5(5x + 24)$**

20. The area of a high school basketball court is $(50x - 300)$ square feet. Factor $50x - 300$ to find possible dimensions of the basketball court. (Example 3) **50 ft by $(x - 6)$ ft**